

CLAIMS:

1. A method for accessing a data storage device controlled by array controller processes, the method including the steps of:
- (a) receiving a file system access operation request;
  - (b) determining if the file system access operation request specifies an operation comprising a divertible operation;
  - (c) if the file system access operation request specifies a divertible operation, diverting the divertible operation from file system processes associated with the data storage device to the array controller processes;
  - (d) performing the divertible operation with the array controller processes; and
  - (e) updating a file system data management arrangement with operation result information from the array controller processes, the file system data management arrangement being controlled by the file system processes.
2. The method of the Claim 1 wherein the operation comprises a create operation and wherein the operation result information includes a reference to the array storage space to which data for the file specified in the create operation is to be written.
3. The method of the Claim 2 wherein the step of updating the file system data management arrangement includes causing the file system processes to produce an entry in the file system data management arrangement which includes identifying information for the specified data and a reference to the array storage space to which the specified data is to be written.

1 4. The method of Claim 1 wherein the divertible operation comprises a  
2 read operation and further including the step of reading an array  
3 storage space reference for the file specified in the read operation.

1 5. The method of Claim 4 wherein:

2 (a) performing the divertible operation comprises reading data from  
3 blocks allocated to the space identified by the array storage  
4 system space reference; and

5 (b) the operation result information includes an indication that the  
6 read operation is complete.

1 6. The method of Claim 5 wherein the step of the updating the file  
2 system data management arrangement includes causing the file  
3 system processes to modify access data in an entry for the file  
4 specified in the read operation.

1 7. The method of the Claim 1 wherein the step of the determining if the  
2 file system access operation request includes a divertible operation is  
3 performed with a wedge file system interposed between a file system  
4 client and the file system processes associated with the data storage  
5 apparatus.

1 8. The method of Claim 7 wherein the step of determining if the file  
2 system access operation request includes a divertible operation  
3 comprises reading a file attribute for the file specified in the file  
4 system access operation request.

1 9. The method of Claim 7 wherein the step of the determining if the file  
2 system access operation request includes a divertible operation  
3 comprises reading a file size included in the file system access  
4 operation request.

- 1 10. The method of Claim 1 further including the step of modifying the  
2 divertible operation to a form suitable to be performed by the array  
3 controller processes.
- 1 11. The method of Claim 10 wherein the step of modifying the divertible  
2 operation comprises converting the operation from a byte offset  
3 operation to a block access operation.
- 1 12. The method of Claim 1 wherein the step of determining if the file  
2 system access operation request includes a divertible operation is  
3 performed by the file system processes.
- 1 13. The method of Claim 1 wherein the divertible operation comprises a  
2 write or a create operation and the step of performing the divertible  
3 operation with the array controller processes includes passing data for  
4 a file specified in the divertible operation directly from a file system  
5 client to the array controller processes.
- 1 14. The method of Claim 1 wherein the divertible operation comprises a  
2 read operation and the step of performing the divertible operation with  
3 the array controller processes includes passing data for a file specified  
4 in the divertible operation directly from the array controller processes  
5 to a file system client.
- 1 15. A program product for servicing file system access operation requests  
2 from a file system client, the program product stored on a computer  
3 readable medium and including:  
4 (a) operation detection program code for detecting divertible  
5 operations and non-divertible operations in a received file  
6 system access operation request;  
7 (b) file system program code for performing each non-divertible  
8 operation included in a received access operation request and

9 maintaining a file system data management arrangement which  
10 includes information for each file in the file system; and  
11 (c) array controller program code for performing each divertible  
12 operation, managing a data storage device including data  
13 storage media, and communicating with the file system  
14 program code to update the file system data management  
15 arrangement in response to the performance of a divertible  
16 operation.

1 16. The program product of Claim 15 wherein the operation detection  
2 program code comprises wedge file system program code operable  
3 between a file system client and the file system program code.

1 17. The program product of Claim 15 wherein the array controller program  
2 code includes byte access conversion program code for converting  
3 byte offset access instructions in a divertible operation to block  
4 access instructions.

1 18. The program product of Claim 15 wherein the operation detection  
2 program code includes temporary data structure program code for  
3 creating a temporary data structure containing information from the  
4 file system data management arrangement on a file specified in a  
5 received access operation request.

1 19. The program product of Claim 15 wherein the operation detection  
2 program code is incorporated into the file system program code.

1 20. The program product of Claim 15 wherein the array controller program  
2 code includes file system formatting program code for formatting data  
3 messages according to a file system standard for a file system  
4 implemented by the file system program code.

1 21. A program product for servicing file system access operation requests  
2 from a file system client to a file system including a file system data  
3 management arrangement which contains information on each file in  
4 the file system, the program product stored on a computer readable  
5 medium and including:

- 6 (a) operation detection program code for detecting divertible  
7 operations in a file system access operation request received  
8 from a file system client, and for preventing each divertible  
9 operation from being performed by the file system; and  
10 (b) array controller program code for performing each divertible  
11 operation, managing a data storage device including data  
12 storage media, and communicating with the file system  
13 program code to update the file system data management  
14 arrangement in response to the performance of a divertible  
15 operation.

1 22. The program product of Claim 21 wherein the operation detection  
2 program code comprises wedge file system program code operable  
3 between a file system client and the file system program code.

1 23. The program product of Claim 21 wherein the array controller program  
2 code includes byte access conversion program code for converting  
3 byte offset access instructions in a divertible operation to block  
4 access instructions.

1 24. The program product of Claim 21 wherein the operation detection  
2 program code includes temporary data structure program code for  
3 creating a temporary data structure containing information from the  
4 file system data management arrangement on a file specified in a  
5 received access operation request.

1 25. The program product of Claim 21 wherein the array controller program  
2 code includes file system formatting program code for formatting data  
3 messages according to a file system standard for a file system  
4 implemented by the file system program code.

1 26. A data storage system comprising:

- 2 (a) a data storage device;
- 3 (b) data processing means for,
- 4 (i) determining whether a file system access operation
- 5 request includes a divertible operation,
- 6 (ii) if the file system access operation request includes a
- 7 divertible operation, passing the divertible operation to
- 8 array controller processes executed by the data
- 9 processing means,
- 10 (iii) performing the divertible operation with the array
- 11 controller processes, and
- 12 (iv) updating a file system data management arrangement
- 13 with operation result information for the divertible
- 14 operation from the array controller processes;
- 15 (c) an input/output arrangement connected to the data processing
- 16 means for passing communications between a file system client
- 17 and the data processing means; and
- 18 (d) an interface between the data processing means and the data
- 19 storage device.

1 27. The apparatus of Claim 26 wherein the data processing means  
2 comprises:

- 3 (a) an array controller executing the array controller processes; and
- 4 (b) a file system processor executing file system processes and
- 5 maintaining the file system data management arrangement.

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28. The apparatus of Claim 26 wherein the input/output arrangement includes:
- (a) an input/output port having a physical input/output connection; and
  - (b) a network protocol stack component operatively connected to the input/output port.
29. The apparatus of Claim 28 wherein the network protocol stack component provides network interface facilities for both the array controller and the file system processor.

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